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Establishing forages

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A key element in profitable forage production is good stand density. Inadequate stands can be the result of poor initial establishment, mismanagement during grazing or harvest, fertility limitations, or any of a number of 'natural calamities' such as freeze, flood or just long periods of wet (or dry!) weather.

Productive stands start at establishment. Some producers routinely achieve good to excellent stands, while others routinely don't. The difference is usually in paying attention to details in the establishment steps taken. Forage establishment is more than 'getting the seed in the ground as cheaply as possible'. More consistent forage seeding successes come with carefully managing all the steps during establishment; seedbed preparation; seed selection and handling; providing adequate fertility; proper seeding technique; and manipulation of companion crops, if used, and competing weeds.

The majority of the forage grasses and legumes used in Iowa and the upper mid-west U.S. are best characterized as 'cool-season, perennials'. These species persist for several years under the local climatic variation, and grow best during the spring and autumn months. They exhibit very little growth in the winter, and most years exhibit some degree of summer dormancy. The information is paper is primarily directed toward establishment management of cool-season forages. Other frequently used forage species are classified as 'warm-season' species; some grow as perennials, some as annuals. They germinate and grow best during warmer months and in warmer soil conditions. Information addressing specific differences in establishment management for warm-season forages is presented at the end of the paper.

Methods of seeding

Forage seedings can be made several ways. This paper primarily addresses the establishment of a new forage stand into a tilled seedbed either by broadcasting seed or using a drill. For information on other seeding methods such as broadcasting seed or drilling seed into an existing sod or an herbicide-killed sod, see the list of ISU Extension publications in the References section.

This author refers to the metering and placement of forage seed as the steps of 'seeding technique'. Excellent 'seeding technique' includes: 1) uniform distribution across the seeded area (whether broadcast or drilled); precise, final depth of seed placement (no deeper than ¼ to ½ inch, after all passes of seeding equipment); and excellent seed-to-soil contact. The type of seeding equipment used and attention to details of seeding technique in its use is a very important step in successful forage establishments.

Seeding with a grain drill or no-till drill

Forages may be seeded into a tilled seedbed with a conventional grain drill or no-till drill equipped with small grass and/or legume seeding attachments. Drills vary greatly in configuration and design to accurately meter and deliver seed of varying sizes and densities.

At a minimum, a drill designed for forage seeding should have a separate seed box and seed metering mechanism for small-seeded legumes. A seed box and metering units suitable for small-seeded forage grasses is also desirable. Some drills have attachments designed for larger, light/chaffy seeds such as smooth bromegrass. Producers frequently adapt to their drill limitations and blend smooth bromegrass seed with oats or other companion crop, and meter the mixture through the small grains box/metering unit. Grain drills vary in how seed is placed in the seedbed. Some literally 'dribble' the seed from the seed metering unit at the seed box, in effect, serving as a broadcast seeder. Some drills have short metal tubes that scatter the seed again, essentially a broadcast distribution on the soil surface. Still others have longer tubes that deliver in front of, in, or behind the furrow openers.

No-till drills, though originally fabricated for drilling into living sod, have been successfully used to seed forage and gains into un-tilled or minimally-tilled row-crop fields, and into herbicide-killed sod. In addition to the need for appropriate seed boxes, metering mechanisms, and seed placement units, no-till drills generally also have disks or coulters for cutting through sod or crop residues.

The 'seeding technique' challenge with drills, however they are set up, is to also provide for precise, shallow seed coverage and excellent seed-to-soil contact. To accomplish this, some drills have furrow opener or seed placement 'shoes' with depth control, provided by either depth control band's on the disk opener, or by manipulation of spring pressure on the seed placement openers and the linkage with a following press wheel. Other drill operators, using the drill as a broadcast seeder, attempt to cover the seed with drag chains, or more successfully with the use of a following cultipacker, that covers the seed shallowly, and provides desirable seed-to-soil contact. If drills are equipped with press wheels, check to see if they are 'tracking' well over the seeded row, and are not pressing the seed too deep.

Broadcasting seed onto tilled seedbed

Broadcasting is the least desirable seeding method, but is widely used for forage seed distribution. In addition to possible lack of seed depth control and seed-to-soil contact, broadcast seeding usually leads to poor uniformity of seed spread. Seeds differ in size, weight and shape, thus spread differently when broadcast. Watching broadcast overlap patterns carefully and even scattering seed in two directions may be necessary for even seed distribution. Efficiency of a broadcast seeding can be greatly increased by rolling or cultipacking the seedbed before and after the seed is broadcast.

Cultipacker seeders

Cultipacker seeders do an excellent job of seeding. They meter seed, cover, and provide seed-to-soil contact in one operation. Most of them consist of two corrugated rollers with a seed box mounted on top of the frame directly between the two rollers. Seed is dropped between the corrugated rollers, which firm seedbed, shallowly cover the seed, and provide good seed-to-soil contact.

The ability to meter and place seeds of different sizes, accurately is one of the 'details' important for successful forage seedings. When considering the establishment of long-term forage stands, and are tempted to 'compromise some control by using the equipment you already have', an economical option may be to rent a suitable drill or hire the seeding done correctly.

Time of seeding

The growth characteristics of the species and the local climate sets some practical limits on when forages are most successfully established. The 'target seeding times' for cool-season forages are in the early spring (March through April), late summer (Aug. to mid- Sept.), and for some species, during the winter dormant months.

Spring seedings

March and April often offer the best probability of adequate soil moisture and suitable temperatures for seed germination and seedling development. New spring forage seedings have traditionally been accompanied by a small cereal grain companion crop such as oat. (See section on Managing Companion Crops).

Late-summer seedings

When moisture is available, August into early September offers an additional period for seeding cool-season forage. Cool-season perennial forage legumes and grasses generally need 6 to 8 weeks of growing time as a seedling to establish and be able to successfully survive the winter months. This 'time for enough growth' determines the time-frame for late-summer seeding. This is not 'fall seeding'. Delaying seeding beyond these dates, or delayed germination due to dry soil condition at seeding increases the risk of cold injury to seedlings. Many of the cool-season forage grasses can be established successfully from seedings in early to mid-September, but the cool-season forage legumes should be planted in August.

Having adequate soil moisture at seeding and during subsequent seedling establishment is the most frequent risk associated with late-summer forage seedings. Advantages of late-summer seedings are: that rainfall events in the autumn are less intense, thus less erosive (late-summer seedings may not require a companion crop); competition from weeds is lower; and, if done successfully, stands begin growth early and are remarkably productive the following growing season.

Seeding during the winter dormant period

Forage legumes are sometimes successfully established by broadcasting on existing pasture acres in late winter (February to early-March; a practice called 'frostseeding' – (See References for an ISU Extension Bulletin on Frostseeding)

Warm-season perennial ('prairie grasses) are sometimes planted during the winter months (November and December, as a 'dormant seeding'. The expectation is that the seed will not germinate until soils warm sufficiently (about 50^0F or more). Some producers attempt to sow cool-season grasses and legumes in November and December, as a 'dormant seeding' too, but with less success. The cool-season species can germinate at soil temperatures in the mid 30's° F., and those soil temperatures can occur during extended ' mid-winter thaw' periods This is considered to be a high risk method, because . Subsequent cold can severely injure the partially germinated seedlings.

Seedbed

Lack of soil moisture during germination and seedling development is a major limitation for forage seedings. Providing for a firm, well packed seedbed is the best management practice that you have for improving seed-root zone moisture availability. Rolling or cultipacking before seeding firms the soil below the seed. Rolling after seeding packs the soil around the seed and provides good moisture contact between the seed and the soil. If a seedbed is to be firmed only once, do it before seeding. This will make a firm seedbed and prevents seeding too deeply in the soil. Seeds emerging from greater depths are often so weak that survival is not likely.

Methods of seedbed preparation depend on the steepness and rockiness of the soil and the existing vegetation. Moldboard plowing, or the use of a field cultivator are common primary tillage practices. On sloping sites, manage vegetation as killed sod or leave crop residue on the surface or incorporate it shallowly as a mulch. The mulch may seem to be a nuisance at seeding time, but it offers protection for the small seedlings as well as erosion control.

Lime and fertilizer

The fertilizer applications most often associated with forage seedbed preparation and establishment are lime for needed soil pH correction and 'corrective' phosphorus and potassium. A soil test will help determine the amounts of lime, phosphorus and potassium that should be provided before seeding.

Legumes and their nitrogen fixation benefit most from correcting soils to a near neutral soil pH (7.0 on the pH scale). Grasses produces satisfactorily at neutral or slightly lower pH (6.0 to 7.0). Incorporating limestone into the seedbed contributes to correction of soil acidity and supplies calcium and magnesium. Lime also affects the availability of most of the other essential elements needed for forage production. The 'neutralization of soil acidity by lime' is not immediate. Lime is most effective if incorporated six months to a year before seeding. This timing is best accomplished when the forage seeding is part of an on-going crop rotation. If the new seeding is an immediate renovation of a previous forage site, incorporation of lime as early as possible before the new seeding is recommended

Many research studies shows that available phosphorus, applied and incorporated into the root zone, is beneficial for seedling legumes and grasses, and is the most efficient use of fertilizer phosphorus. Incorporation of corrective potassium during seedbed preparation is also an efficient way to use this fertilizer nutrient.

Nitrogen, while an important fertilizer nutrient for forages, encourages the competitiveness of associated companion crops and weeds. So, limit nitrogen application at seeding time. Manure applications ahead of seeding also increase companion crop and weed competition.

Managing companion crops

The majority of spring forage seedings in Iowa and the upper mid-west U.S. have been and continue to be accompanied by a small cereal grain companion crop such as oat. These cereal companion crops establish rapidly and provide erosion protection on tilled, surfaces. While the cereal companion crops are frequently allowed to mature and are harvested for grain and straw, the long duration of plant completion contributed by the companion crop may delay or inhibit the establishment of the forage species. Cereal grain companion crops can be harvested or

grazed at a less mature developmental stage for forage. An earlier removal of competition often improves the extent and rate of forage species establishment.

Producers using companion crops are faced with conflicting goals. New seedings benefit from the erosion–protecting value of companion crops on sloping sites. Some producers cite the value of grain, straw, or forage as an economic necessity to offset some of the costs during the seeding year. Others credit the competitiveness of the companion crop as their primary weed control mechanism. In reality, this competition is equally detrimental to the underseeded forages.

The competitiveness of a spring-planted companion crop can also be lessened by reducing the companion crops seeding rate. With spring sown cereals such as oats, being used as companion crop with forage seeding, it is desirable to reduce the normal cereal seeding rate by approximately one-third to one-half. These reduced companion crop stands still contribute erosion protection, as well as acceptable yields of grain, straw or forage.

In addition to excessive competition, new forage seedings sometimes fail because the rapid growth of the companion crop obscures the presence of damaging insects and diseases, leading to delays or disregarding timely pest management decisions. Where commercial or optimum grain production is the primary goal of the cereal grain crop, a practical strategy may be to grow and manage the cereal crop for grain and delay the forage seeding to be a late summer seedings after grain harvest.

Seed, seeding rates, mixture, and seed inoculation

Producers are quick to assume that the seed quality is the primary cause of seeding failures, when factors such as weather, soil fertility, and numerous other factors contribute. Then, again, sometimes the problem is seed quality. The germination and viability of seed is influenced by its maturity, storage time, and conditions under which it has been stored. Use disease and weed seed-free seed. Purchase seed from a reliable source, and use certified seed of recommended varieties when it is available. Poor seed is never a bargain at any price. Planting high seeding rates to compensate for poor germination seed lots is seldom a satisfactory seed management solution.

When planting mixtures of grasses and legumes, the species selected should be suitable for the intended use(s), and similar in palatability, maturity patterns and growing vigor. Simple mixtures of a couple well adapted grasses and one or two well adapted legumes are more likely to establish and remain productive in a pasture or hayfield setting; more diversity is not always better. Seed dealers often have ‘ready-made’ mixtures available. Study the composition of these mixtures to determine if you really need or want the various components.

Inoculate legumes

Plant newly inoculatedl legume seeds at seeding time regardless of the previous crop grown. Inoculation enables the legume to “fix” atmospheric nitrogen and make it available to the growing plants. Most legume species are only compatible with a specific inoculant type, so be insistent that the seed dealer provides the correct inoculants. Many seed companies sell pre-inoculated seed. This method of inoculation is effective if the seed is ‘fresh’ and has been stored properly. Inoculant bacteria are ‘perishable’. Whether you use pre-inoculated seed or inoculate your own, keep the inoculated seed in a cool place between time of inoculation and planting, and try to plant the inoculated seed as soon as possible after inoculation. A guideline is to plant freshly inoculated seed within 24 hours. For pre-inoculated seed, use within three to four months after treatment. If there is any doubt about viability of the inoculant, or if the seed is carried over from the past year, re-inoculate before seeding. Appropriate soil pH is important for nodulation and nitrogen fixation. Research and producer experience shows that legumes planted on low pH sites, may germinate well and produce acceptable stands, however, they usually have limited nodulation and do not produce at their yield potential.

Alfalfa seeding – herbicides for competition control

In Iowa and the upper mid-west U.S. alfalfa is the most commercially important forage legume. Significant research and commercial product development is directed at establishment and monument of the alfalfa crops in the region. The information provided above on forage establishment is applicable to pure-stands of alfalfa. There are also some additional management practices that can be considered for specialized alfalfa seedings. Briefly they include:

Using herbicides to aid in the establishment of alfalfa

There are an increasing number of herbicides being labeled for use in alfalfa establishment. They include pre-plant incorporated herbicides such as Balan, Eptam and Treflan. As grass-control tools they contribute significantly to the control of grassy weeds in new alfalfa seedings. In addition, there are a number of grass-only, broadleaf-only and broad-spectrum post-emergence herbicides. While the pre-plant and the grass-only and broad-spectrum, post-emergent materials are designed for pure alfalfa seedings, the broadleaf-only post emergence herbicides may be appropriate for use on mixed alfalfa and grass seedings. Glyphosate may fall into this management discussion, IF the alfalfa variety being grown is glyphosate tolerant, and it is being managed as a pure stand of alfalfa.

Herbicides for establishment weed management is most appropriate for relatively level, low erosion risk sites. Post-emergence grass-only and broad spectrum herbicides have been used successfully as management tool with cereal grain companion crops on sloping sites, where the companion crop is used as a temporary erosion protection, and then killed in place with herbicides before they become excessively competitive. Where seeding year weed and companion crop competition is being managed with herbicides, there may be some seeding-year alfalfa advantage to seeding at slightly higher seeding rates. The increased stand density and seeding year yield makes the use of herbicides very attractive to alfalfa producers.

For a more complete coverage of some of these alfalfa-specific practices, see the reference listed below.

Managing new seedings

Weeds and overgrazing are often the most serious problems for newly established stands of grasses and legumes. If weeds are a threat, mow them. They are best controlled by mowing relatively frequently, to a height near that of the tips of the developing forage seedlings. A rotary mower is usually superior to a sickle mower because it tends to mulch the weeds and prevents smothering the young plants. Ensure that the mower spreads the clippings. Spring sown pasture should be grazed rotationally, just often enough to use the oats and prevent them from shading the new seedlings. Avoid trampling in wet weather. When the new seeding is grazed, do not graze shorter than 4 inches. Be alert for damaging infestations of insect pests, such as potato leafhopper, army worms and grasshoppers. Protect the new pasture from grazing after Sept. 15 in the first grazing season.

Establishing ‘warm-season’ forages

When establishing warm-season, perennial grasses, such as switchgrass or big bluestem, only minor variations are needed in the forage establishment steps and management.

Time of seeding

The primary seeding period for warm-season perennial grasses is late April though May. Delaying seeding into June and as late as July increases the risk of drought injury to the slow-establishing seedlings. Don’t seed warm-seasonperennial grasses in late-summer. Consider dormant seedings in November or December. There has been some success using a low-population corn crop in a co-seeding with warm-season perennial grasses in the seeing year. Plant annual, warm-season grasses from mid-May through early-July.

Fertilization

Limit nitrogen fertilizer on perennial, warm-season grass seedings in the seeding year. Annual, warm-season grasses benefit from modest applications of nitrogen to increase yields.

Seed selection and handling

Warm-season perennial grass seed often contains a significant amount of ‘inert matter’ and seed dormancy, and thus is sold and planted on the basis of ‘Pure Live Seed’ (PLS). Additionally, seed of some warm-season, native, prairie grass species has long appendages that make it quite light and bulky. Specialized warm-season grass seeders are often required for successful metering of these seeds. Many species of warm-season, native, prairie grass species have a significant degree of dormancy when freshly harvested. Special storage, or dormant-season planting is frequently beneficial when planning for establishing these species.

Managing competition

Weeds are often strong competitors in new warm-season grass seedings. They are best controlled by mowing relatively frequently, to a height near that of the tips of the developing forage seedlings. A rotary mower is usually superior to a sickle mower because it tends to mulch the weeds and prevents smothering the young plants. Ensure that the mower spreads the clippings. Avoid mowing newly seeded warm-season grass seedings after August. 15.

References

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